Title: Fractions on a Number Line

Brief Overview:

Students will study proper fractions, improper fractions and mixed numbers with like and unlike denominators using number lines. In the first lesson, students complete activities to help build number sense related to fractions, improper fractions and mixed numbers. Lesson two focuses on identifying and plotting fractions and mixed numbers on a number line, emphasizing that fractions represent equal parts. The final lesson includes a culminating activity in which the students must properly place fractions with different denominators on a number line. The lessons were designed to help build conceptual knowledge prior to teaching how to determine least common denominators.

NCTM Content Standard:

Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers.

Grade/Level:

4-5.

Duration/Length:

Three 60-minute math periods. (The unit assessment will be on day 4).

Student Outcomes:

Students will:

- Identify proper and improper fractions and mixed numbers on a number line.
- Plot proper and improper fractions and mixed numbers on a number line.
- Compare proper and improper fractions and mixed numbers using a number line.

Materials and Resources:

Day 1

- Fraction Strips/Bars
- String or Fishing Line
- *Pre-assessment*
- *Number Line Cards*
- *Fraction Sort*
- *Identifying Fractions and Mixed Numbers*
- *Identifying Fractions and Mixed Numbers Key*
- *Enrichment Fractions and Mixed Numbers*
- *Exit Ticket: Fraction Number Sense*

Day 2

- 3 bananas (insert a pin into the banana to cut the first into halves, second into thirds, and third into fourths). Do not peel the bananas.
- Fine point dry erase markers for each student
- Plastic sleeves
- Paper clips
- Sentence strips
- *Representation Cards 1-4*
- *Number Line Resource*
- *Fractions on a Number Line handout*
- *Fractions on a Number Line: Enrichment*
- *Exit Ticket: Fractions on a Number Line*

Day 3

- Sentence strips
- *Paper folding activity*
- *Who is Winning?*
- *Who is Winning Key*
- *Fraction War*

Day 4

- *Post assessment*

Development/Procedures:

Day 1

Pre-assessment

- Have students complete pre-assessment, *Fractions on a Number Line.* An answer key is provided.

Engagement

- Have 2 students hold the ends of a large string to create a number line. Use the number line cards and place the 0 and 5 number cards on the number line. Distribute the additional whole number cards and the mixed number cards that include halves to the students. Have students place the mixed numbers on the number line. Ask students how they determined where to place the number. Explain that a number line shows number relationships because as you move from left to the right, the numbers increase. So 2 ½ is greater than 2 because it comes after 2 on the number line, but less than 3 because it comes before 3.

Exploration

- Pose question for consideration: What do you notice about the fractions that are equal to one-half and close to one-half?
- Students complete *Fraction Sort* using the fraction cards provided.

- After sorting, order the fraction cards from least to greatest.

Explanation

- Distribute a set of fraction bars to each student or each group of two students
- Draw a number line on the board and ask students to think what mixed number is represented when you put a dot or tick mark halfway between 2 and 3. The number is greater than 2 but less than 3. It is halfway between 2 and 3. The number is 2 ½.
- Add another tick mark to show 2 ¼ . What do you know about this mixed number? It must represent a number smaller than 2 ½ because it comes before the 2 ½ mark. It is larger than 2 because it comes after 2. It is exactly half of thedistance between 2 and 2 ½. Using the fraction bars, I am looking to see what fraction bar is exactly half of one half (1/4). So this number must be 2 ¼.
- Look at some number lines that have tick marks and use the fraction bars and see if we can identify where the mixed numbers go.
- Plot 3½ and 3¼. How many halves are in 3 wholes? How many fourths are in 3 wholes?
- Use your fraction bars and show 3 ¾. How many wholes did you use? How many fourths? What if you use only fourths to show 3 ¾, how many fourths would you need?
- Use your fraction bars to show 2 ½ . Use fraction bars to show 8/5. Which is greater? (Emphasize the greater the length or measurement, the greater the fraction or mixed number).

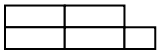
Extension (Students apply/practice the learning.)

- Have students complete *Identifying Fractions and Mixed Numbers* using their fraction bars for help. An answer key is provided.

Differentiation

- Reteach

  Use index cards (whole and pieces cut into halves, thirds, and fourth). Display two whole index cards so that they are touching but not overlapping. Underneath lay out 2 ½ index cards.

  Reinforce the idea that the length of 2 index cards is shorter than the length of 2½ index cards. Repeat with other whole and mixed numbers of index cards to reinforce as you move from left to right on a number line the numbers increase.

- Enrich

  Students determine how many thirds, halves, fourths, and eighths there are in 3 wholes by converting to improper fractions. Students can complete *Enrichment Fractions and Numbers*.

  Create a number line that includes mixed numbers, proper, and improper fractions.

Evaluation

- Students should now complete *Exit Ticket: Fraction Number Sense*. An answer key is included.

Day 2

Engagement

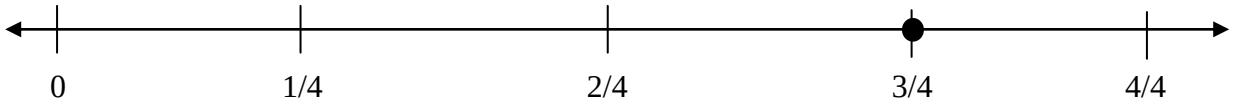
- Magic Banana Fractions:
  Use three pre-cut bananas – see note under materials (one in halves, one in thirds, and one in fourths).
    - Using the first banana (halves), ask the students how many "cuts" need to be made to divide the banana into halves (one). Have a student demonstrate by making an imaginary cut.
    - Have another student peel the banana to show halves.
    - Follow the same steps for both thirds and fourths – emphasizing the number of cuts that need to be made for each.
    - Ask the students "What is the definition of a fraction? (equal parts of a whole or set) Were all the bananas cut into equal parts? (yes) When we put fractions on a number line, should they also be "cut" into equal parts? (yes)

Exploration

- Put students into groups of 2 or 3.
- Distribute *Representation Cards* #1-4 to each group.
- Instruct the students to look carefully at each card, and answer the question at the bottom of the sheet with their group members.

Explanation

- Review the answers to representation cards 1-4 with the students:
    - Card # 1: the number line does not match the picture because the picture represents 1/4 and the number line represents 1/3 (review that a denominator represents the total number of equal parts)
    - Card #2: the number line does not represent the same fraction because the parts of the number line are not equal (demonstrate the proper way to show 5/6 on a number line)
    - Card #3: the picture and number line both show 7/10 (equal parts)
    - Card #4: the picture represents 1 4/6 (or 10/6) while the number line represents 4/6 (discuss where the point should go – and other ways it can be written: 1 4/6 or 1 2/3)
- Distribute *Number Line Resource* in plastic sleeves, dry erase markers and erasers to each student.
- Model how to accurately place fractions and mixed numbers on a number line by "cutting" the number line. Explain to the students: "Just like our magic banana activity, number lines need to be broken into equal parts. The number of "cuts" is one less than the denominator. Start making "cuts" at the halfway point for all even denominators. For example: to represent ¾ on a number line, separate the number line between zero and one into 4 equal parts by placing 2/4 at the halfway point. Then place evenly spaced "tick marks" at ¼ and 3/4. Label each fraction and place a point on ¾.



- Model additional examples for both fractions and mixed numbers:
    - 1/3
    - 7/8
    - 1 1/6
    - 2 3/10

- Have students try their own examples one at a time. Model answers to each one.
    - 2/3
    - 5/6
    - 4/10
    - ¾

Extension

- Distribute student resource, *Fractions on a Number Line*. Have students complete independently.

- Review answers to the handout.

Differentiation

- Reteach
    - Use fraction strips to create number lines with equal parts. Example: For fourths, put all 4 fourth strips together to make one whole. Draw a number line the length of the fraction strips. Put tick marks at the separation point of each strip, so that they are evenly spaced.

- Enrich
    - Play "Find Grampy". On this site, students gain a better understanding of fractional parts by determining the correct fraction for Grampy's location:
        - http://www.visualfractions.com/FindGrampy/findgrampy.html
    - If a computer is not available, students can use *Fractions on a Number Line: Enrichment* to practice the same skill.

Evaluation

- Have students complete the exit ticket, *Fractions on a Number Line. An answer key is provided.*

Day 3

Engagement

- Distribute a sentence strip to each student. Have them draw a line lengthwise along the sentence strip.
- Without dividing the line, ask the students to estimate and label where ¼ , ½, and 5/8 is on the number line.
- Ask the students "How can we check to see who is right? Into how many equal parts do we need to divide the sentence strip into – since we don't have the same denominators?" Discuss equivalent fractions and model how to divide the line into 8 equal parts.

Exploration

- Distribute blank paper along with instructions for the *Paper Folding Activity*. Have students complete the activity and answer questions at the bottom.

Explanation

- Review the meaning of the denominator. It names the total number of equal parts.
- Discuss the answers to the questions on the bottom of the *Paper Folding Activity*.
- On a number line, you have fractions of different denominators. In other fraction models that you have worked with (fractional parts of a region and fractions of set) the total equal parts names the denominator. Model how to create a number line for each fraction and compare 3/4 and 2/3, you have to break the number line into 4 equal lengths and then into three equal lengths in order to compare fractions with denominators of four or three (12 total).
- Introduce the activity *Who is Winning*? Explain that they will use what they know about fractions on a number line to help them determine who is winning the race.
- Students can predict who they think will win the race before they start plotting the points on the number lines.

Extension

- Students complete the *Who is Winning*? activity sheet independently. An answer key is provided.

Differentiation

- Reteach
    - Have students use fraction bars or strips to model each person's progress in the race. Reinforce the idea of the denominator and how many thirds are in 12 equal parts? How many fourths are in 12 equal parts and so on.

- Enrich
    - Students can determine how much further each racer needs to go to the finish line. Example: Kyle has completed 2/3 of the race so he needs to complete another 1/3. Bonus question is found at the bottom of *Who is Winning*?
    - Drag and Drop Fractions on a Number Line : http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks2/maths/fractions/level4.htm
    - Students can play *Fraction War*.

Evaluation (Ongoing formative assessment for Day 3)

- Check student answers for accuracy on the *Who is Winning*? activity sheet.

Summative Assessment:

Students will complete the *Post Assessment, Fractions on a Number Line.* An answer key is provided.

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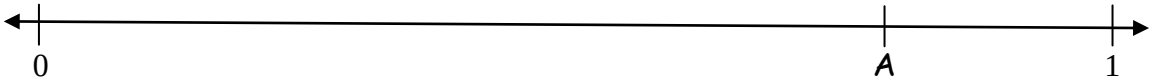
Pre- Assessment: Fractions on a Number Line

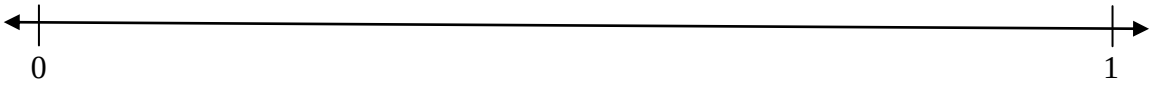
1. Which fraction is closest to one whole?
   a. $\frac{1}{4}$
   b. $\frac{1}{2}$
   c. $\frac{3}{4}$
   d. $\frac{3}{8}$

2. Where would you place 2 ½ on a number line?
   a. halfway between 0 and 1
   b. before 2
   c. halfway between 2 and 3
   d. after 3

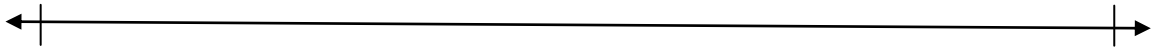
3. What fraction is represented by the point A on the number line below?
   a. 1/5
   b. 1/4
   c. 4/3
   d. 3/4



4. Divide the number line below and place $\frac{5}{6}$ in the correct place.



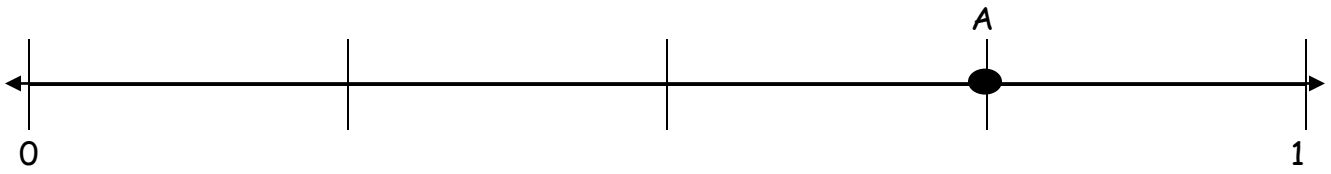
Divide and label the number line below. Place $2\frac{1}{3}$ in the correct place.



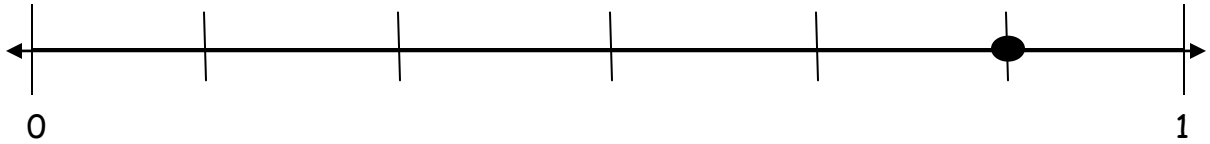
6. Which is larger: 5/12 or 3/5? _____

Answer Key (Pre-Assessment: Fractions on a Number Line)

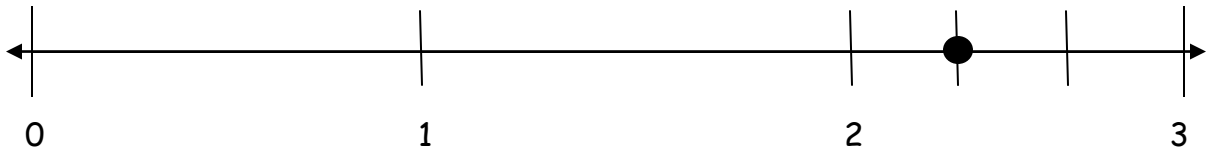
5. Which fraction is closest to one whole?
   a. $\frac{1}{4}$
   b. $\frac{1}{2}$
   c. $\frac{3}{4}$
   d. $\frac{3}{8}$
6. Where would you place 2 $\frac{1}{2}$ on a number line?
   a. halfway between 0 and 1
   b. before 2
   c. halfway between 2 and 3
   d. after 3
7. What fraction is represented by the point A on the number line below?
   a. 1/5
   b. 1/4
   c. 4/3
   d. 3/4



8. Divide the number line below and place $\frac{5}{6}$ in the correct place.

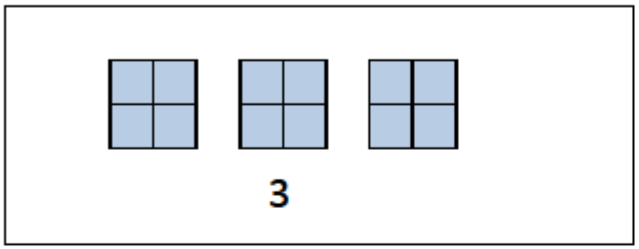


9. Divide and label the number line below. Place $2\frac{1}{3}$ in the correct place.



6. Which is larger: 5/12 or 3/5? <u>3/5</u>

FRACTION NUMBER CARDS



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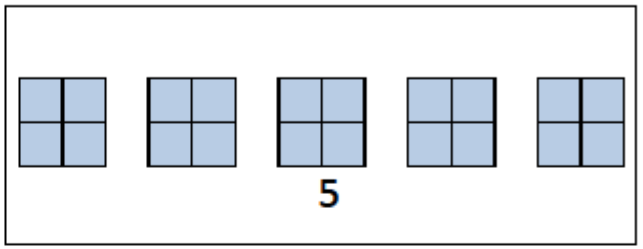

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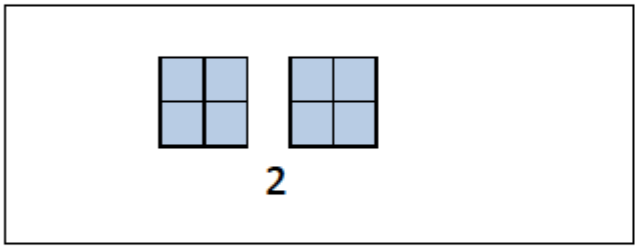

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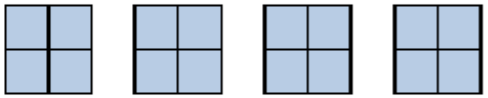

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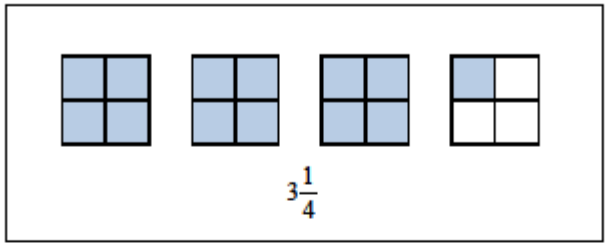
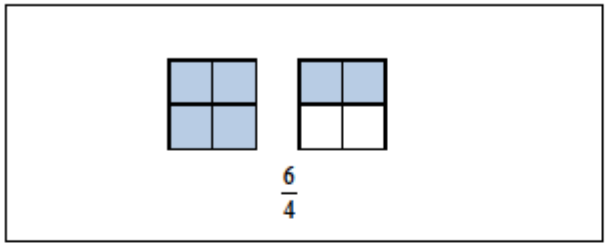
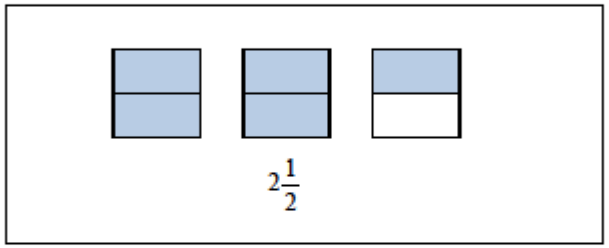
FRACTION NUMBER CARDS



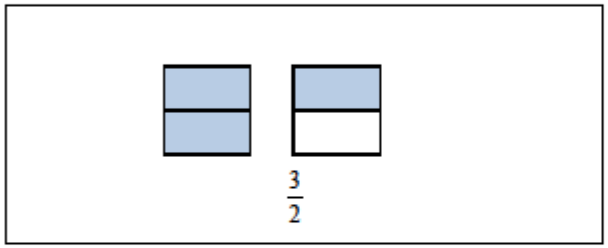
$3\frac{1}{4}$



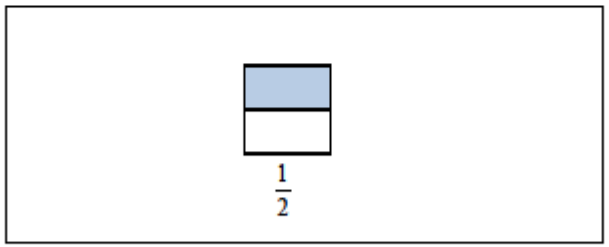
$\frac{6}{4}$



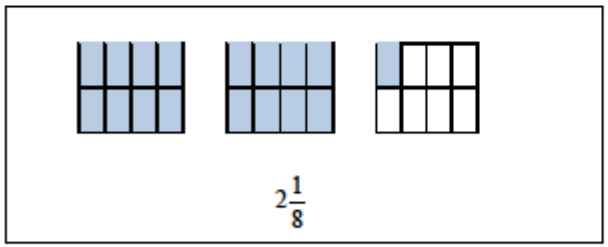
$2\frac{1}{2}$



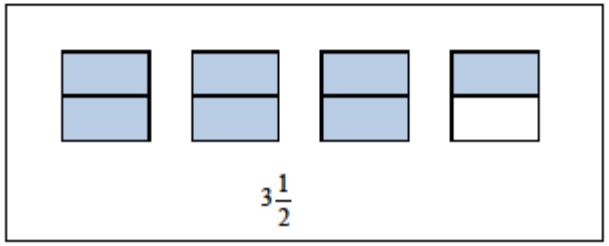
$\frac{3}{2}$



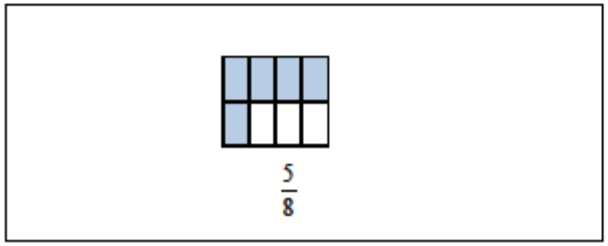
$\frac{1}{2}$



$2\frac{1}{8}$



$3\frac{1}{2}$



$\frac{5}{8}$

Fraction Sort

Fractions Close to Zero	Fractions Close to $\frac{1}{2}$	Fractions Close to 1 Whole

$\frac{1}{12}$	$\frac{11}{12}$	$\frac{3}{7}$	$\frac{2}{15}$	$\frac{11}{10}$	$\frac{3}{6}$
$\frac{1}{5}$	$\frac{5}{12}$	$\frac{4}{7}$	$\frac{1}{6}$	$\frac{8}{9}$	$\frac{4}{9}$
$\frac{5}{11}$	$\frac{3}{3}$	$\frac{3}{5}$	$\frac{7}{8}$	$\frac{2}{11}$	$\frac{9}{11}$

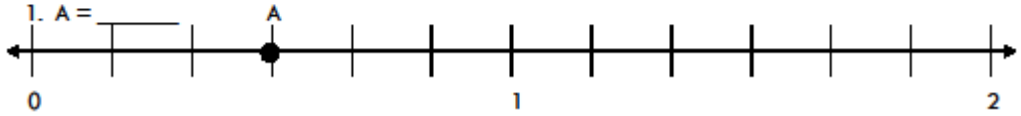
FRACTION SORT CARDS

Name _____ Date _____

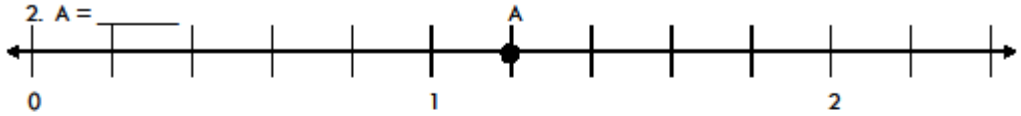
Identifying Fractions and Mixed Numbers

Directions: For each number line, identify the fraction or mixed number where A is located.

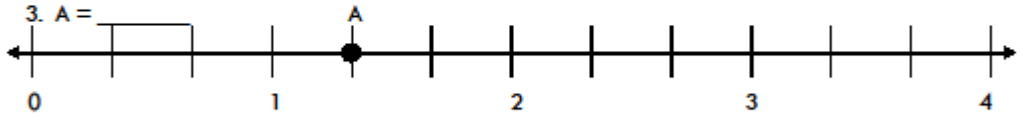
1. A = _____



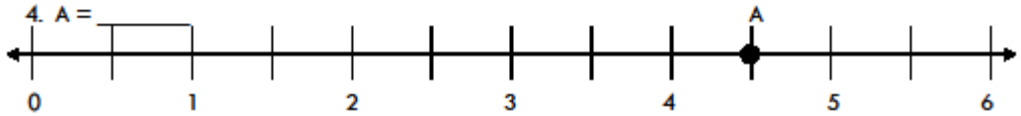
2. A = _____



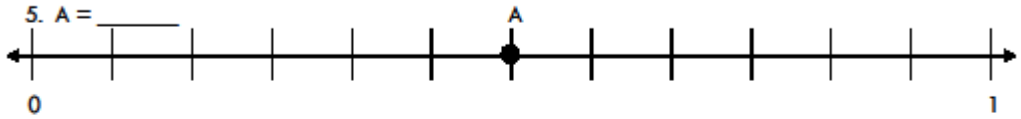
3. A = _____



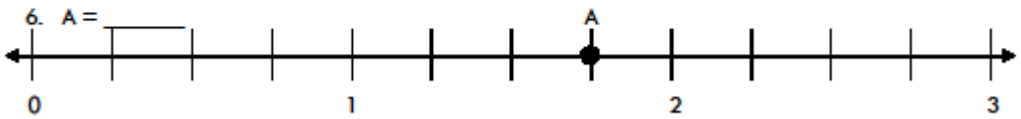
4. A = _____



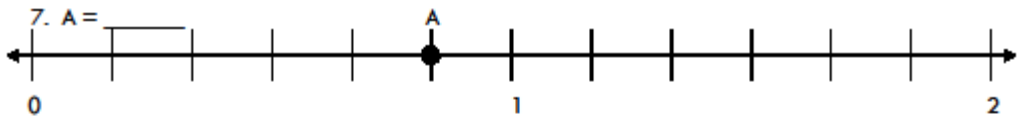
5. A = _____



6. A = _____



7. A = _____



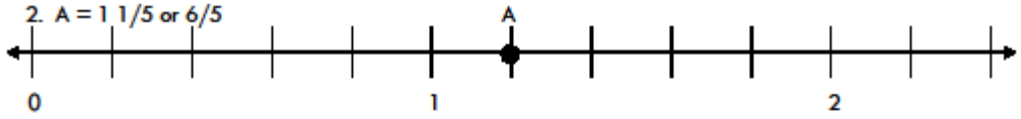
8. A = _____

Answer Key (Identifying Fractions and Mixed Numbers)

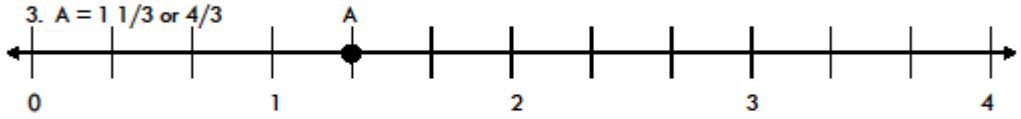
Directions: For each number line, identify the fraction or mixed number where A is located.

1. A = ½ or 3/6

2. A = 1 1/5 or 6/5



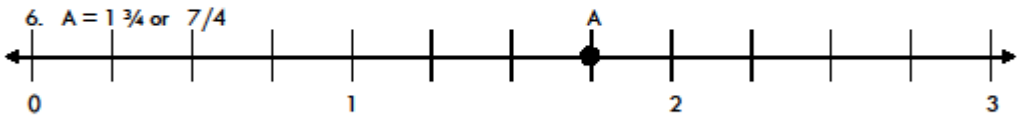
3. A = 1 1/3 or 4/3



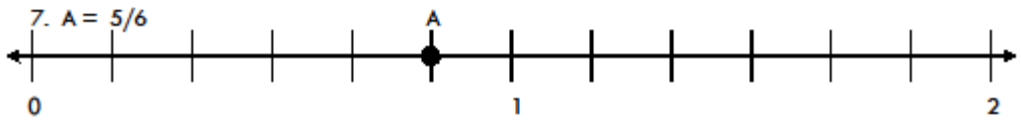
4. A = 4 ½ or 9/2

5. A = 6/12 or 1/2

6. A = 1 ¾ or 7/4



7. A = 5/6



8. A = 3 2/3 or 11/3

Name _____
Date _____

Enrichment Fractions and Mixed Numbers

Directions: Use fraction bars or strips to help you create a number line that includes mixed numbers, proper, and improper fractions. Your number line must include at least 2 mixed numbers, 1 improper fraction, and 2 proper fractions.

Name _____

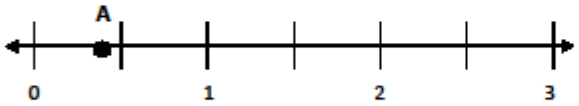
Date _____

EXIT TICKET: Fraction Number Sense

Directions: Read the statements below. Circle true or false for numbers 1 and 2.

1. $2\frac{1}{2}$ is equal to $\frac{5}{2}$ True False

2. Point A is located at 3/4 True False



3. How do you determine if a fraction is close to 1/2?

_____

_____

_____

_____

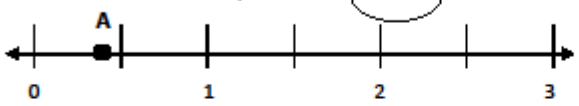
_____

ANSWER KEY (EXIT TICKET: Fraction Number Sense)

Directions: Read the statements below. Circle true or false for numbers 1 and 2.

1. $2\frac{1}{2}$ is equal to $\frac{5}{2}$ (True) False

2. Point A is located at 3/4 True (False)

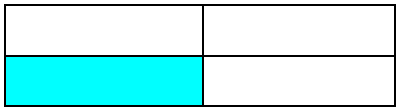


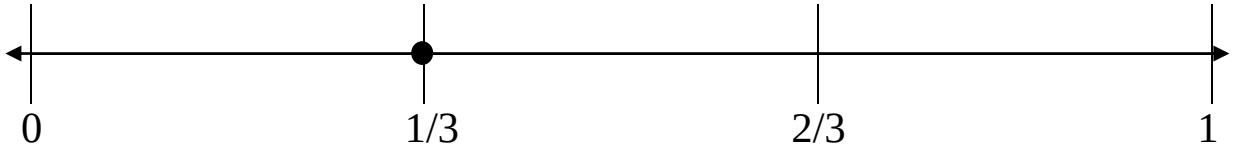
A is plotted before the ½ tick mark so it is less than ½ and ¾ is greater then ½ so it is false.

3. How do you determine if a fraction is close to ½?
A fraction is close to one half when the numerator is about half of the denominator. For example, if the numerator is 5 and the denominator is 10 the fraction is equal to 1/2 so 6/10 and 4/10 are close to one half.

Representation Card #1

Does the number line below represent the same fraction as the picture?

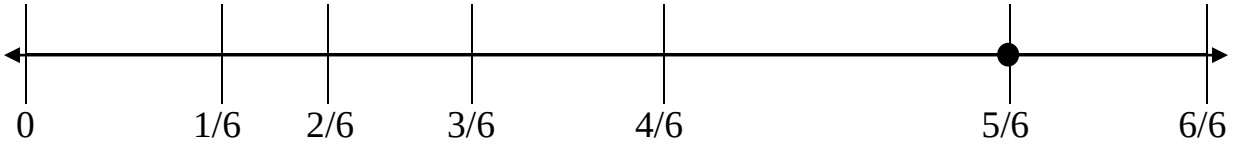




Why or Why not?

Representation Card #2

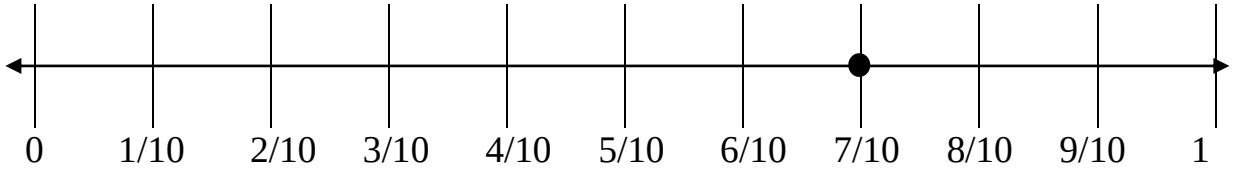
Does the number line below represent the same fraction as the picture?



Why or Why Not?

Representation Card #3

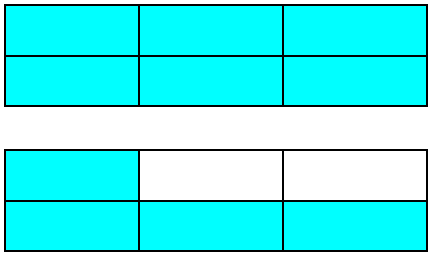
Does the number line below represent the same fraction as the picture?

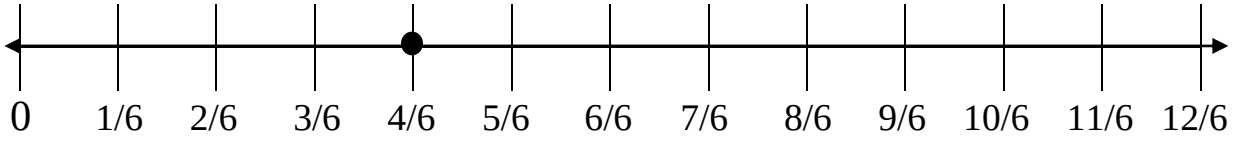


Why or Why Not?

Representation Card #4

Does the number line below represent the same fraction as the picture?





Why or Why Not?

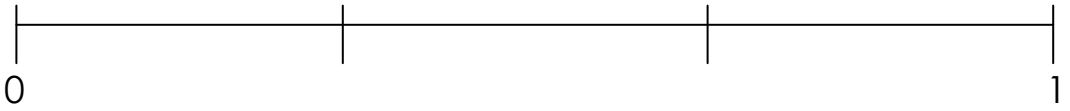
Number Line Resource

Name _____

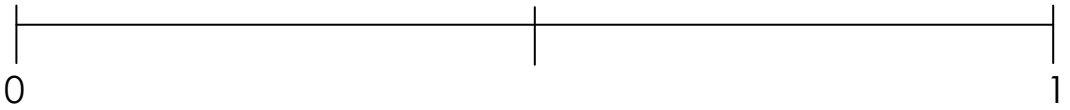
Fractions on a Number Line

Label each number line with the fractional parts.

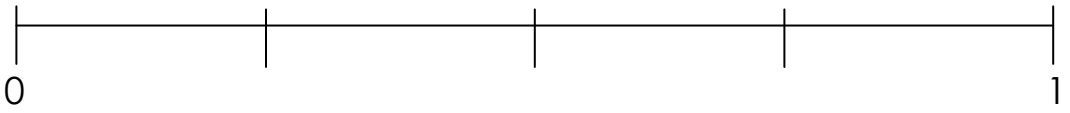
1.



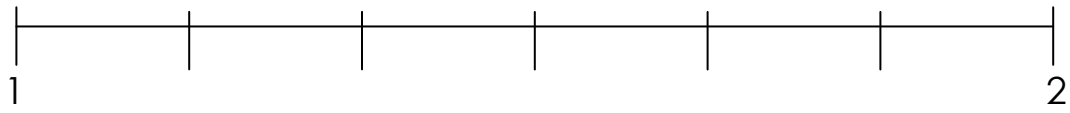
2.



3.

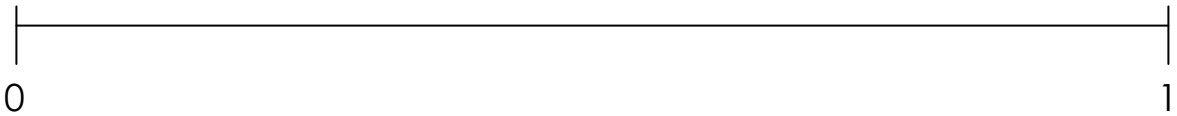


4.

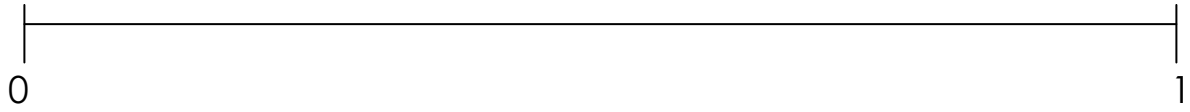


Divide and label each number line to find the location of each fraction.

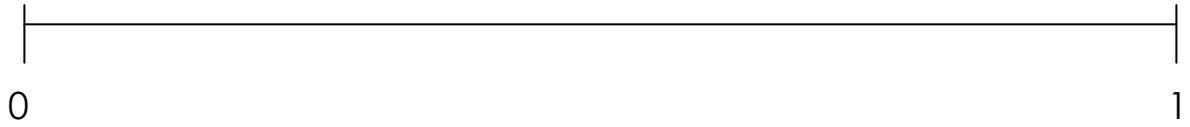
1. 3/4



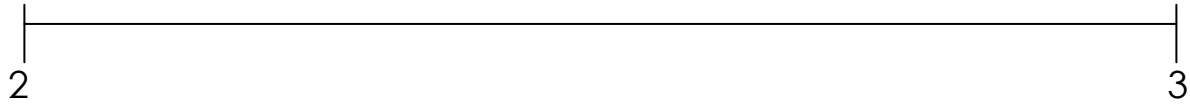
2. 2/3



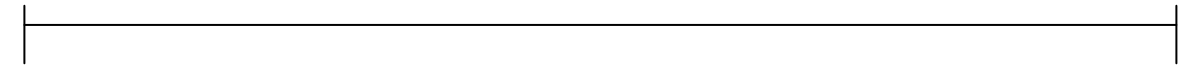
3. 5/8



4. $2\frac{2}{6}$



5. $3\frac{7}{8}$

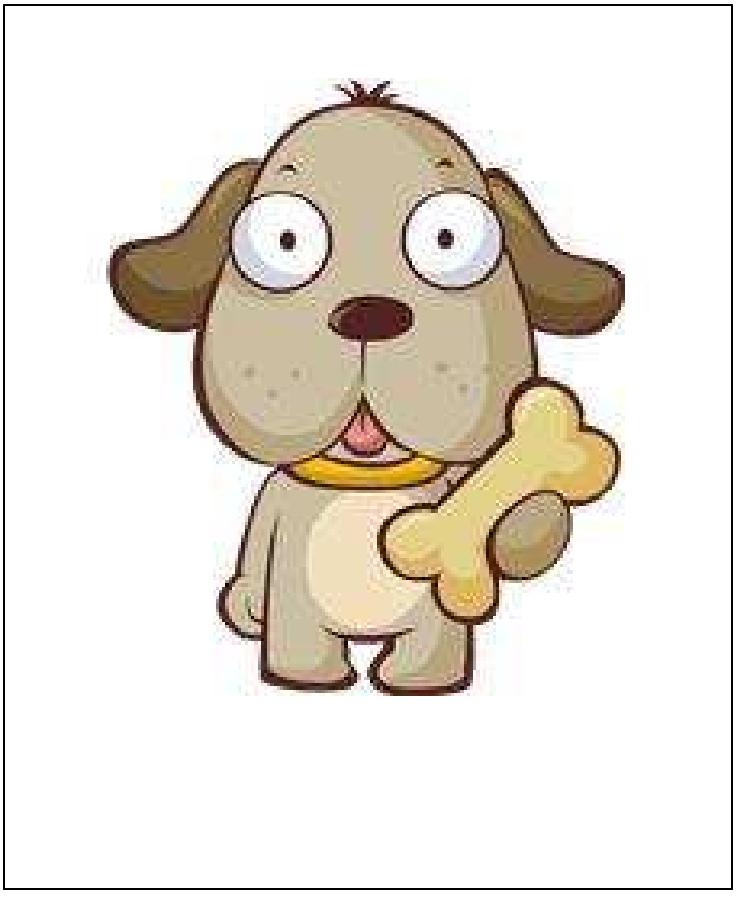


Fractions on a Number Line: Enrichment

Materials: pencil, paper clips, sentence strips

Partner Activity:

1. Cut out "Scruffy" below.
2. Partner One: Place Scruffy along a blank sentence strip and secure with paper clips. Hold the sentence strip at both ends. Tell partner Two a number between 3-12 to represent the denominator (the denominator will represent the whole sentence strip.
3. Partner Two: Try and guess the numerator of the fraction based on Scruffy's location.
4. Partner One: Use a pencil to "Cut" the sentence strip into equal parts (based on the denominator). Determine if partner two is correct.
5. Flip sentence strip over and switch places with your partner.

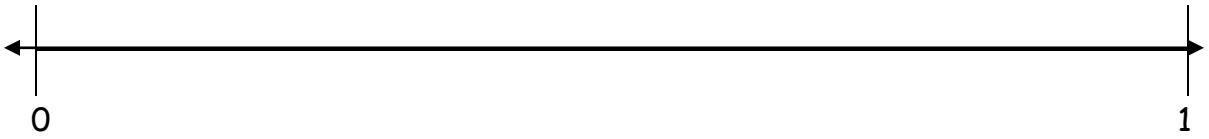


Name:

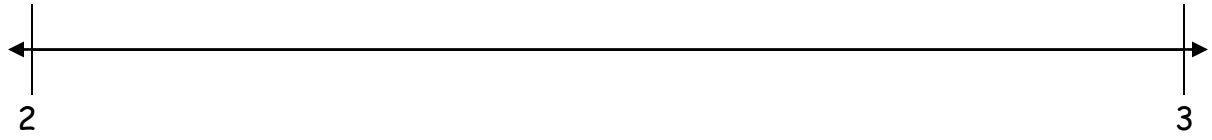
Exit Ticket: Fractions on a Number Line

1. What fraction is represented by the point on the number line below? _____

2. Cut the number line below and place $\frac{1}{3}$ in the correct place.



3. Cut the number line below and place $2\frac{5}{6}$ in the correct place.



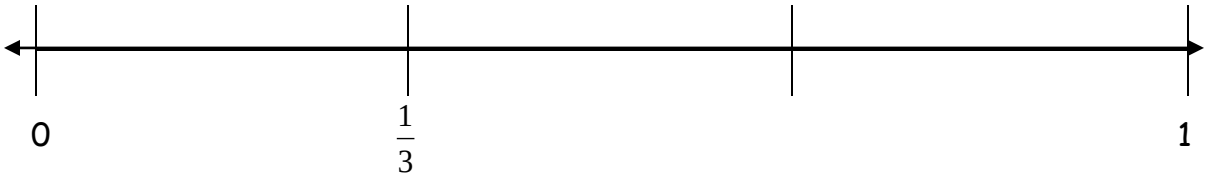
ANSWER KEY

Name:

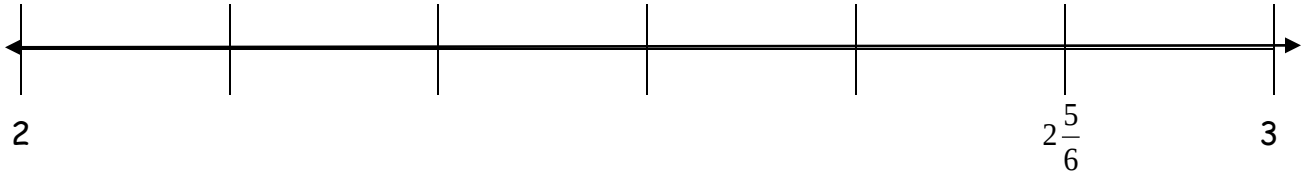
Exit Ticket: Fractions on a Number Line

1. What fraction is represented by the point on the number line below? _2/5____

2. Cut the number line below and place $\frac{1}{3}$ in the correct place.



3. Cut the number line below and place $2\frac{5}{6}$ in the correct place.



Paper Folding Activity: Number Lines

1. Using a blank sheet of paper, fold the paper lengthwise (hot dog style).
2. Draw a line lengthwise about an inch above the crease.
3. Place a tick mark at each end, labeling 0 on the left and 1 on the right.
4. Keep the paper folded lengthwise.
   a. Now fold the paper in half (hamburger style) and crease. Unfold just this fold. Mark a tick mark at the crease of the line and label $\frac{1}{2}$.
   b. Repeat the fold from step a., then fold a second time. Unfold, add tick marks at the creases and label the fourths (1/4, and 3/4).
   c. Repeat the folds from step a & b., then fold a third time. Unfold, add tick marks to the creases and label the missing fractions.
   d. Repeat the folds from step a.-c., then fold a fourth time. Unfold, add tick marks at the creases and label the missing fractions.

Questions:

1. Does the number line you created remind you of anything we use in math?

2. When you placed the fourths on the number line, why didn't you have to label 2/4?

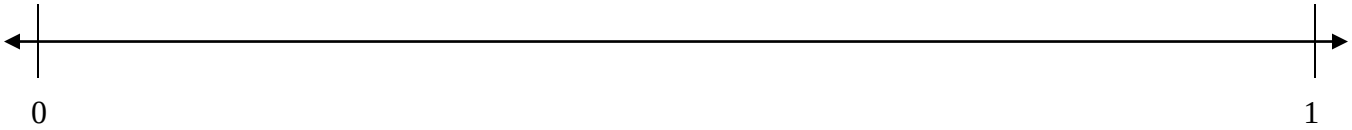
3. How did you know what denominator to use in steps c. and d.?

Name _____ Date _____

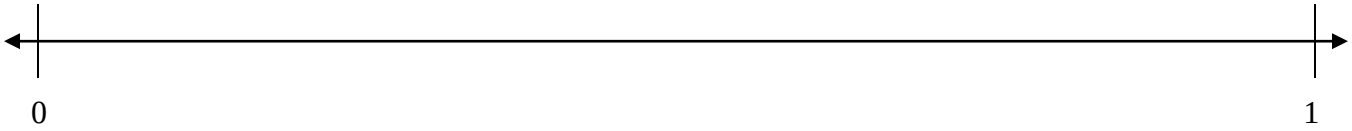
Who is Winning?

To determine who is winning the race, you must plot how much of the race they have completed on the number line. Once you have plotted each person's distance, you must transfer all of the information to the number line below and write the person's name who is winning.

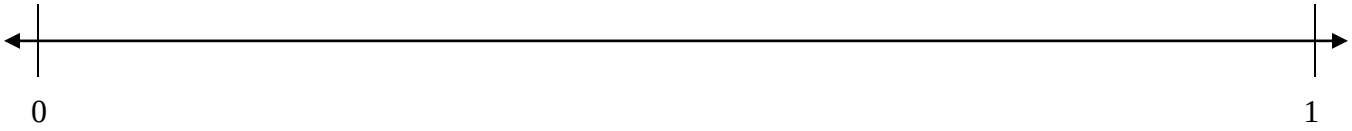
1. Miguel has completed $\frac{4}{6}$ of the race.



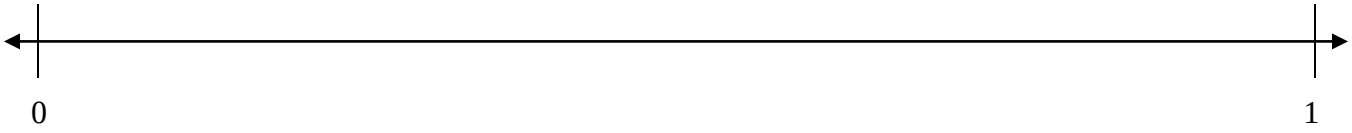
2. Robin has completed $\frac{9}{12}$ of the race.



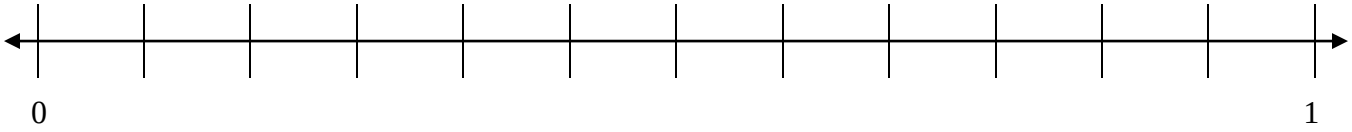
3. Kyle has completed $\frac{2}{3}$ of the race.



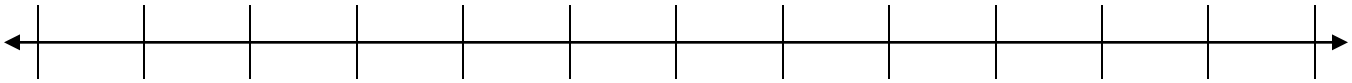
4. Curtis has completed $\frac{3}{4}$ of the race.



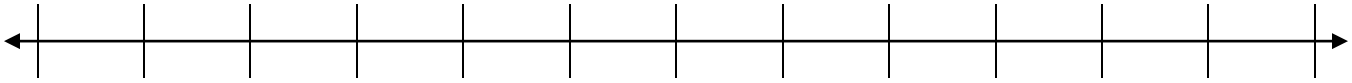
5. Kristina has completed $\frac{5}{6}$ of the race.



6. Stacey has completed $\frac{1}{2}$ of the race.



7. Who is winning? Plot where everyone is in the race on the number line.



_____ is winning the race.

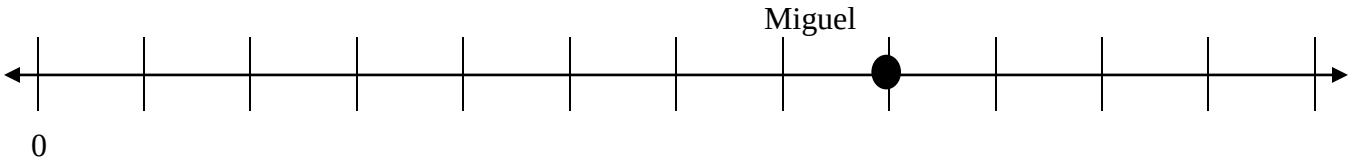
BONUS
Find the distance that each person still needs to go in order to finish the race. Example, if Jon has completed 1/12 of the race, then he still needs to go 11/12 in order to cross the finish line.

Racer	Fractional Part Completed	Fractional Part Needed to Finish
Miguel	4/6	
Robin	9/12	
Kyle	2/3	
Curtis	3/4	
Kristina	5/6	
Stacey	1/2	

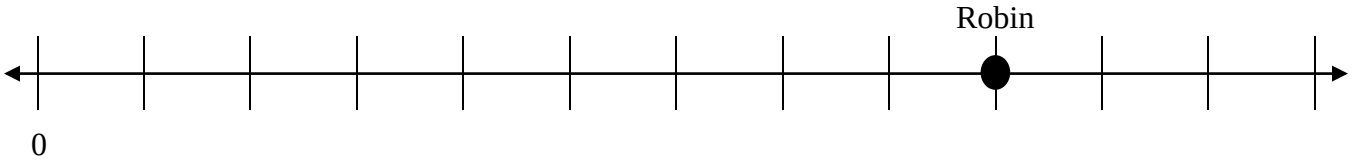
Answer Key (Who is Winning?)

To determine who is winning the race, you must plot how much of the race they have completed on the number line. Once you have plotted each person's distance, you must transfer all of the information to the number line below and write the person's name who is winning.

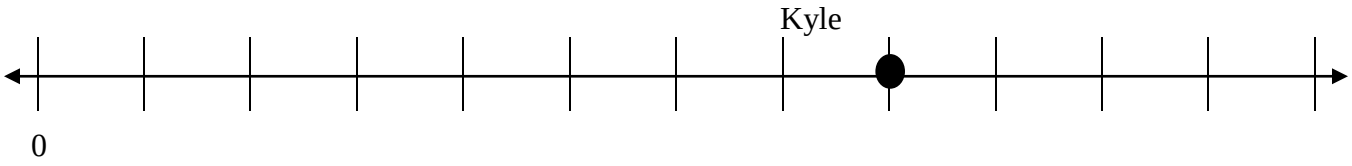
1. Miguel has completed $\frac{4}{6}$ of the race.



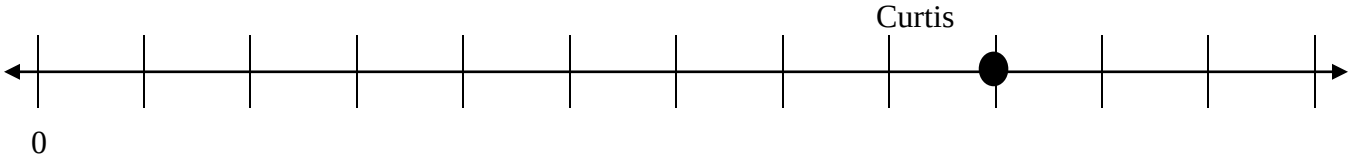
2. Robin has completed $\frac{9}{12}$ of the race.



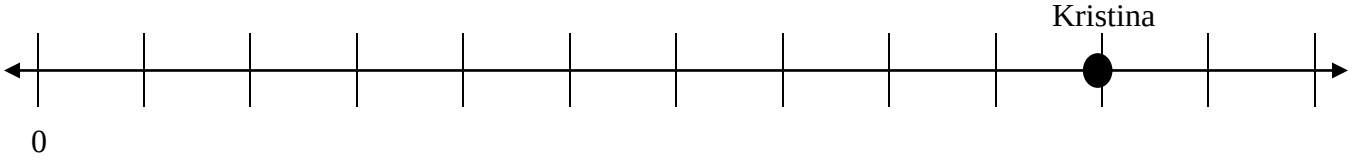
3. Kyle has completed $\frac{2}{3}$ of the race.



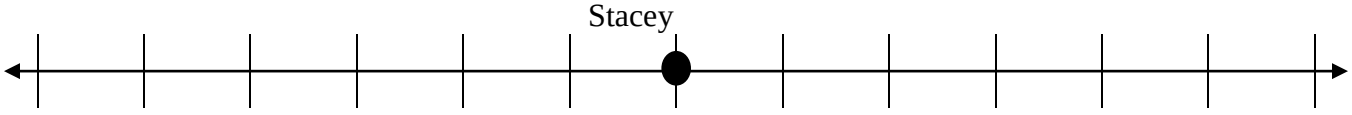
4. Curtis has completed $\frac{3}{4}$ of the race.



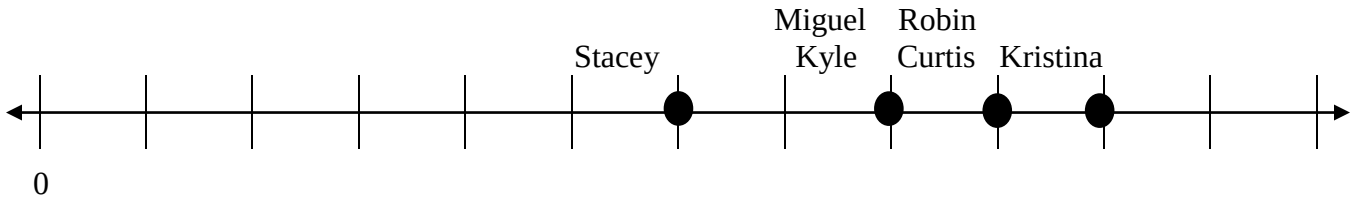
5. Kristina has completed $\frac{5}{6}$ of the race.



6. Stacey has completed $\frac{1}{2}$ of the race.



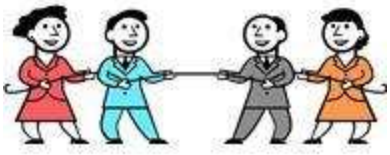
7. Who is winning? Plot where everyone is in the race on the number line.



Kristina_____ is winning the race.

BONUS
Find the distance that each person still needs to go in order to finish the race. Example, if Jon has completed 1/12 of the race, then he still needs to go 11/12 in order to cross the finish line.

Racer	Fractional Part Completed	Fractional Part Needed to Finish
Miguel	4/6	2/6
Robin	9/12	3/12
Kyle	2/3	1/3
Curtis	3/4	1/4
Kristina	5/6	1/6
Stacey	1/2	1/2



Fraction War

Play With 2-4 players

1. Using a regular deck of cards, deal the cards out evenly to each player.

2. Keeping the cards face down, each player turns over their top two cards. The first card turned over is the numerator, and the second card is the denominator.

3. Use the strategies you learned in class to compare your fraction to the other players' fraction(s). The player with the highest fraction wins all of the cards.

4. The player with the most cards at the ned of the game is the winner.

Notes:

- Picture cards = 10 and aces = 1
- If two fractions are equivalent (and are the highest fraction), divide the cards up evenly among the winners

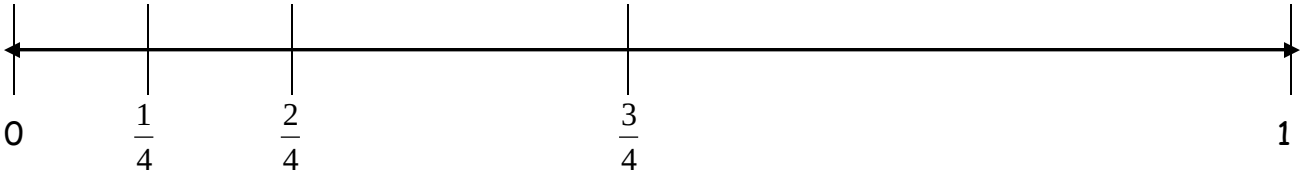
Name:

Post- Assessment: Fractions on a Number Line

1. Which fraction is closest to zero?
   a. $\frac{1}{6}$
   b. $\frac{2}{3}$
   c. $\frac{1}{4}$
   d. $\frac{2}{1}$

2. Is this the proper way to represent the fraction $\frac{3}{4}$ on a number line?

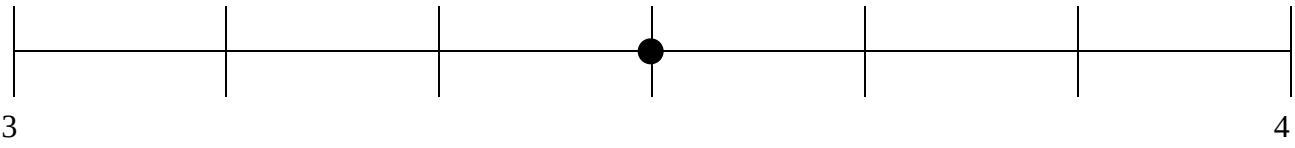
   Circle: Yes No

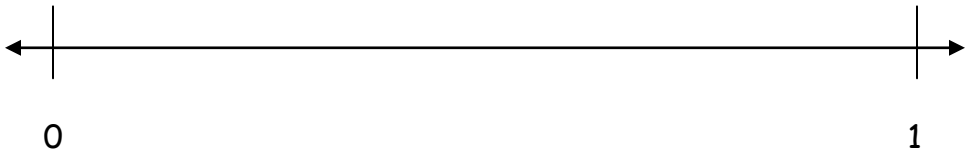


Why or why not? _____

_____

3. What fraction or mixed number is represented by the point on the number line below? _____





5. Use the number lines below to compare 2/3 and 5/6. Which is larger? ____

Mitchell's teacher asked him to divide the number line below and order the following fractions.

3/4 1/2 5/8

Step A Place the fractions on the number line.

Step B
Explain how you determined your answer (OR EXPLAIN WHY YOUR ANSWER IS CORRECT) . Use what you know about in your explanation. Use words, numbers, and/or symbols in your explanation.

Answer Key (Post-Assessment: Fractions on a Number Line)

1. Which fraction is closest to zero?

   (a.) $\frac{1}{6}$

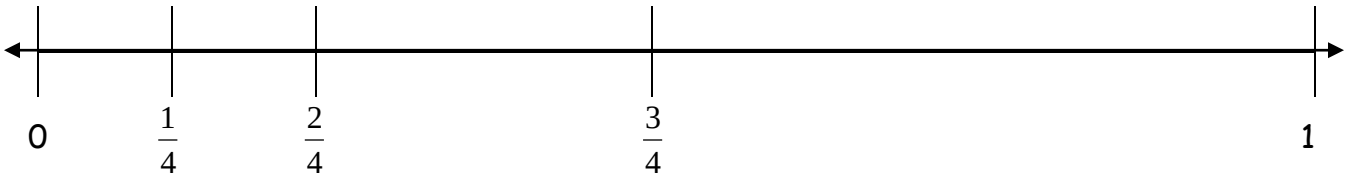
   b. $\frac{2}{3}$

   c. $\frac{1}{4}$

   d. $\frac{2}{1}$

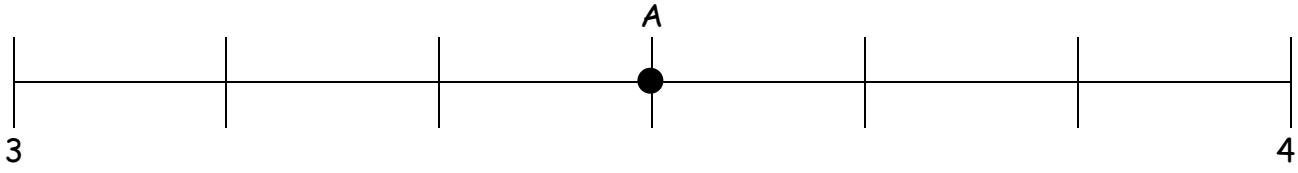
2. Is this the proper way to represent the fraction $\frac{3}{4}$ on a number line?

   Circle: Yes (No)

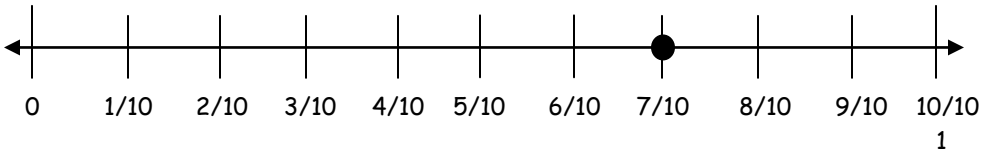


Why or why not? Although the number line is divided into 4 parts, the parts are not equal. 3/4 is located halfway between 0 and 1 so that should be 1/2.

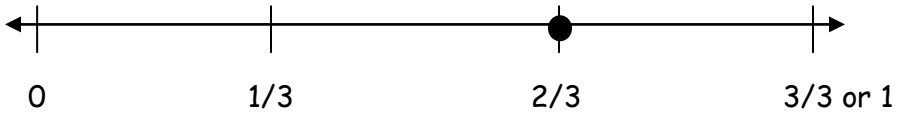
3. What fraction or mixed number is represented by A point on the number line below? $3\frac{1}{2}$, $3\frac{3}{6}$

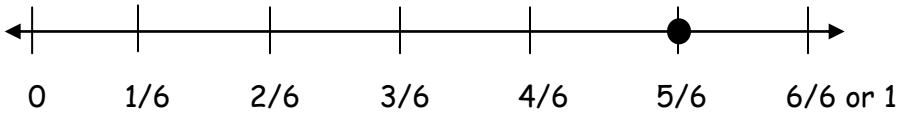


4. Place the fraction represented by the picture below on the number line:



5. Use the number lines below to compare 2/3 and 5/6. Which is larger? <u>5/6</u>



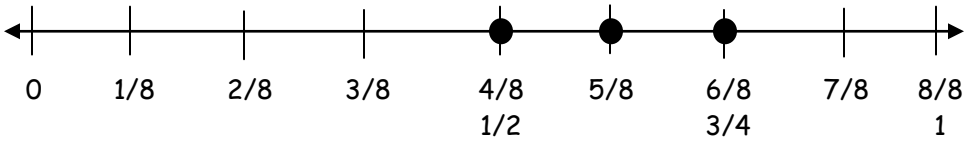


6. BCR

Mitchell's teacher asked him to divide the number line below and order the following fractions.

3/4 1/2 5/8

Step A Place the fractions on the number line.



Step B

Explain why your answer is correct. Use what you know about fractions in your explanation. Use words, numbers, and/or symbols in your explanation.

1/2 divides the number line into 2 equal parts or is half the distance between 0 and 1.

3/4 is the same as 6/8 because when you divide the number line into four equal parts (fourths) and eight equal parts (eighths) the distance from 0 is the same. Once you divide the number line into 8 equal parts, the numerator 5 counts how many eighths you count over from 0.